

**Tentative MAC Minutes
Monday, January 10, 1994**

The meeting was called to order by chairman Dave Bagby at 1:40PM, Kerry Lynn secretary.

- Approval of the minutes from the previous meeting of the MAC subgroup

pg 13 change Bob Grow to Alex Herman (also pg 14, Motion #1)

pg 34, line 31: change "line" to "lunch"

pg 35, line 5: delete "involved", add "submitting MAC proposals"

pg 35 fix "Third ballot results" to agree with Plenary minutes (ballots returned 85, DFWMAC 42 votes)

Approved as ammended by acclamation

- On to Agenda topics:

Tasks for the week

- Follow directions given by Nov. 802.11 Plenary
- Clean up Issues Log to reflect foundation adoption
- Draft text for insertion into draft standard to reflect decisions and current foundation

Directions from Nov Plenary session:

- Accept DFW MAC as the direction of 802.11 working group
- Instruct MAC SG to:
 - Proceed to study and enhance proposal this by vote
 - Answer and resolve questions relative to its performance
- When a subgroup has something that can pass by simple majority that it be offered back to the plenary for 75% approval.

- MAC subgroup voting discussion

Dave Bagby Several people have suggested that we limit voting in this group to 802.11 voting members; how does group feel?

Jim Shuessler Leave things as they are - our decisions still have to be ratified by plenary - last meeting was an aberration.

Kerry Lynn Leave things as they are - we've had this discussion before and always reach same answer - besides, I don't like changing rules in middle of game.

Michael Fischer Our new instructions (see above) will solve previous problems

Straw poll: Leave things as they are (all present vote in SG)

- Draft text discussion

Dave Francois can't edit log and standard too, have three volunteers to help (Jim S, Greg Ennis, Bob O'Hara). They will put text into draft standard.

Francois Simon We can close issue and then write text into the draft standard, or vote on text in plenary (and close issues as a result of the decision(s) taken).

Kerry Operating rules say we must close issues with 75% vote before entering text into draft standard.

Dave Believes issues have been closed implicitly by foundation vote.

Kerry That was my concern at last meeting.

Michael The issues must still ultimately be considered as a whole, whether we close them one at a time or not.

Dave We need to move forward. Procedures cannot be used in an obstructionist manner.

Greg Ennis We can write text that closes several issues.

Jim S I believe we are back in "normal" mode - the Issues Log has become more of a hinderance than a help.

Kerry No problem with this approach, but changing text is harder than adding - would rather see consideration before text is added rather than after.

Dave We have a mechanical problem. There were decisions made. We now need our document to reflect those decisions. Objects to using process to delay implementation of decisions.

Jim S The issues log process should be reworked to reflect current realities.

Marvin Sojka New log should be reflective of the foundation

Dave Roberts Text should drive issues rather than other way around

Break 3:00-3:20

Dave Our goal is to create a quality standard. You should feel empowered to fix broken issues.

- MAC schedule discussion

Dave *Straw poll* - how many people think all the features we've heard about can be included by Nov? <no response> What absolutely has to be there? (Is time-bounded service optional? sec.)

Jim S Identify and prioritize major functional areas of the standard. There has to be a cutoff date for new functionality

Francois One-to-one correspondence between functions and service primitives. Do primitives first and put off detail until later.

Dave Major Functional Areas:

PAR Requires

- Async data
- TBS
- BSS and ESS
- Multi phy support

Hi priority

- Media access (includes:
 - Async data
 - TBS
 - Contention-Free Async)
- ESS support
 - > 1 BSS
- Movement within ESS (continuous roaming? sec.)

Would be nice

- Security
- Infra and AdHoc aspects
- WLAN Mgmt
- Power conservation

Should we assign topics to meetings? Should we do most important parts of each for first draft?

Greg If this is meant to be a time-ordered list then have problems with it.

Dave *Straw polls* - how many think we need a cutoff date for new functionality? <everybody> When should we cut it off? Not Jan (too early), Sept, or Nov (too late). Mar? <15> May? <10> July? <4> Mar or May? <17 & 10 respectively>

Jim S Cutoff is not for detailed solution to existing features, only intro of new ones.

Greg We have in mind cutoff for first draft; argues for Mar.

Sarosh Vesuna Why are we introducing new functionality at all?

Michael What is meant by first draft?

Dave Draft without holes for which you are soliciting input.

Jim S Not trying to stifle innovation, new stuff just goes into next draft.

Bud Koch By new functionality do we mean stuff that's never been on the table? That's a scary thought.

Dave *Straw poll* - how many would cutoff after Jan? <alot>

Michael Short notice. If you mean no new issues raised than OK. Argues for Mar

Motion 1: <Bob O'Hara, Jim S seconds>

Resolved that the MAC group is no longer adding new major functionality to our foundation, we will spend the time between now and the first letter ballot removing "bugs" from our foundation.

Ammend: <Kerry, Michael seconds>

Resolved that the MAC group is no longer adding new major functionality to our foundation after March '94, we will spend the time between now and the first letter ballot removing "bugs" from our foundation.

Bob Q calls, Jim S seconds, question called <30-0-2>

Motion is ammended <22-9-4>

Motion 1 is passed as ammended <27-3-8>

Dave *Straw poll* - How many think feature set must be made smaller?

Michael Yes, but we should wait at least until end of this week before making the call.

Barry Dobyns If we have to truncate DFW, leave hooks

Phil Belanger Shouldn't truncate without doing groundwork first

Kerry We should use breakout groups to establish priorities for each functional area.

Motion 2: <Dave Roberts, second Jim S>

That a formal relook (!) be made at all functionality in the July '94 meeting for the purpose of postponing until a later revision functionality that cannot be completed by the Nov '94 goal date .

Sarosh Would we postpone functionality already in the DFW MAC?

Dave R If the first draft sails through without features, these features will be missing from final draft as well.

Greg calls, Leon Scaldeferri seconds

Motion 2 passes <38-0-6>

- Schedule milestones for completion of draft standard (per above motions):

Jan '94

- Close issues, reflect decisions in draft standard

Mar '94 (802 Plenary)

- No new functions added after this meeting

May '94

July '94 (P)

- Finalize feature set. Revisit progress with possible postponement of features that can't be included by Nov '94 date

Sept '94

Nov '94 (P)

- First draft ready for letter ballot

Adjourn 5:00PM

Tuesday, January 11, 1994

The meeting was called to order by chairman Dave Bagby at 8:35AM, Kerry Lynn secretary.

- Papers from November

IEEE P802-93/208, "A More Detailed Look at Frame Prioritization in a CSMA/CA MAC Protocol", Rick White, Motorola

- Tougher job to detect channel idle w/ FHSS than DSSS.
- Explicit length information in header (protected by CRC) helps state machine determine End Of Frame condition (as opposed to EOF delimiter). Additional CRC on payload. Important point is that no explicit EOF delimiter need be received.
- Highest priority slot will be reserved for station that has already seized the channel. This allows an MSDU to be fragmented in light of high BER on radio channel. ACKs may be sent on per (n) fragment basis ($1 \leq n \leq \text{window size}$).

Dave Roberts Does ACK imply another RTS-CTS exchange (before sending remaining fragments)?

Kerry May raise problems with RTS-CTS if original channel reservation duration is not respected due to retransmissions.

Rick Must contend with other STAs to send frag retries

Wim How is access point relay slot used in FHSS overlap channel situation?

Rick (didn't get answer, sec.)

Dave R What about single channel PHY? Seems like you are forcing control info to occur at a particular point in time

Rick (didn't get answer, sec.)

- A priority time slot can be shorter than normal? Sum of clear channel decision+RxTx+time required by another

STA to detect your tx (about 125 usec)

- Device only uses T Slot if 1) just finished tx data frag or rx own frag ack 2)??

Kerry Does receiver send ACK simply on basis of detecting vacant T Slot, or must it share transmitter's notion of window size?

Rick Simply on vacant slot

Wim Diepstraten But ACK could use T slot instead of A slot if window info is shared. Also, does ACK identify bad frags?

Rick ACK says which frags were received correctly.

Leon Scaldeferrri May not always use full window size, so waiting for that many frags before sending ACK is not correct behavior (or could define "last frag" bit, sec.)

Kerry Notion of window size nonsensical for broadcast pkts? Yes. No ACKs for broadcast or multicast.

- Exp backoff is used when: 1) you want to send packet and is channel busy or 2) failed to receive ACK for transmitted pkt (collision). (#2 implies failure to receive frag ACK could be used to defer remainder of packet.)

Bob O'Hara How can delayed ACK arise?

Kerry If a pkt takes more than 1 window sz and ACKs contain previous history, an early lost ACK could be made up for later?

Rick When sending multiple frags and last can't be ACKd

Dave Bagby These may be proposed changes to foundation.

New Issue: Does MAC do fragmentation/reassembly or do we count on higher layer to give us MSDU size we want? *New function:* AP relay (forwarding) of packet.

Questions to consider when evaluating changes to foundation:

- Is something broken? We must fix it.
- Could something be done better? We need to do cost/benefit analysis.
- Proposed new functionality? Need to study impact on foundation.

How would you rate you paper on these criteria?

Rick

Broken: clear channel assessment (CCA) in FHSS is problem - propose header eval mechanism with len field defined end delimiter. Foundation does not specify CCA, this is one way.

Do Better: Windowing

Dave Straw poll - how many think MAC layer should do frag <many> how many think upper layer should provide MSDUs of MAC specified size? <few>

Michael Fischer Proposes to open new issue:

Is fragmentation done by MAC or higher layer?

Motion 3: <Rick, Kerry seconds >

"That the MAC group define a mechanism to determine if channel is clear or busy and that the mech. used be the one described in paper 93/208; length field in header protected by CRC"

Dave R Premature to decide; not enough argument given on this topic. Invites Rick to present more next time.

Chris Zegelin During ant. diversity PHY is doing CCA, how does this play?

Rick This has been done during preamble

Sarosh We will waste time here; let's get a presentation in joint from PHY group

Motion to divide: <Barry Dobyns, Michael seconds>

3a) "That the MAC group define a mechanism to determine if channel is clear or busy."

3b) "If motion 3a passes, the mech. used to determine if channel is clear or busy be the one described in paper 93/208; length field in header protected by CRC"

Greg Against - aren't we trying to define a mech. that should be done in PHY?

Fred (Kamp?) Must go back to PHY layer, if they can provide then we don't need to. Against until more info

presented.

Wim Should be decided in the PHY. DFW supports PHY independent CCA mech.

Francois Simon Against duplication of effort

Kerry For; boils down to whether we want to define fields in the hdr. PHY can't do this.

Michael Already 1.5 mech's in DFW. Risk in not detecting beginning of pkt. (Layer violation issues?)

Rick Need to reliably detect

Dave R calls, second unknown, question called by voice

Motion 3a fails <12-24-12>

Break 10:35-10:50

Rick Proposes to open two new issues:

Will the MAC support windowing (allowing multi pkts with single ACK)?

Will AP provide priority relay of packets to other devices within BSS?

IEEE P802-94/001, "MAC State Machine Diagrams...", Bob O'Hara, AMD

- 3 communicating state machines (control, tx, rx) to manage async portion of MAC + additional resources (timers, etc.) To provide formal description, focus discussion.

Kerry Isn't use of NAV as CCA optional depending on whether RTS/CTS is used?

Wim When transitioning from R4 to R0, no need to check MPDU_ID at this level. Dup detection should be done at higher layer.

Bob Trying to detect the case where a data pkt is rec'd but it comes from a 3rd STA, not one that sent RTS.

Jim S Let's not debug these diagrams in real time

Michael Would be helpful if actions within states were shown on the diagrams.

Phil Belanger Must set Original_ID on RTS transmission to make Rx State machine work.

Motion 4: <Bob O, Dave R seconds>

"The state machine diagrams and descriptions as ammended be adopted as the description of the 802.11 MAC (in part) and incorporated as such in the draft of the standard."

Laura Hindy If just used to enlighten then OK. But cannot be used as a definitive specification (state transition diagrams not adequate.)

Jim S Premature to include in draft until entire protocol is modeled

Ammend: <Dave, Bob O seconds>

"The state machine diagrams and descriptions as ammended be adopted as the initial description of the 802.11 MAC (in part) and incorporated as such in the draft of the standard."

Motion 4 is ammended by acclamation.

Michael Against, these diagrams are incomplete; do not show optional functions, parallelisms.

Greg Ennis For, these are just to enlighten. Good start, should adopt as initial.

Dave R For, Every protocol spec includes state machine. Should fix these incrementally.

Bob For, just because everything is not shown doesn't mean that what is is incorrect. Argues for incrementalism.

Dave Don't be bashful about adding content to DRAFT standard. We can fix it later if it is incorrect.

Francois State machine is usually a graph. representation of inner workings. Text must prevail in case of conflict, and should be added to draft as well. Must not derive text from state machines, must do it other way around.

Jim S It would introduce more confusion rather than help since it does not reflect text already adopted. Was not done from a top-down approach - does not even leave place holders for significant functionality.

Motion to postpone the motion until next meeting (Mar '94) <Kerry, Jim S seconds>

Phil - against, we'll never finish

Dave - thinks motion is well intentioned but against

Leon - calls, Chan seconds, group passes

Motion to postpone fails <10-28-7>

Francois Just be aware that this will be made public.

End of debate. Motion 4 passed as ammended <30-5-9>

Break for lunch

IEEE P802-94/20, "RF MAC Simulation Highlights", Carlos Puig, Apple Computer

- Subject is how to interpret simulation results.
- RFMACSIM, highly portable, but input and output are textual
- Discrete event simulation based on "smp1" by M.H.MacDougall
- Does all 4 combinations of ACK and RTS/CTS
- Throughput (kbytes/sec) = (offered load) x (acceptance rate) x (completion rate)

Wim Your transfer delay is the same as mine?

Carlos Yes, in general, queueing delay is transfer delay times the queue depth. This sim pkg has a queue and your does not.

- Acceptance vs. completion rates
- Source queue or not
- Receiver RF parameters
- Data pkt length
- Transfer and Queueing delays

KC Most sims compare throughput and delay, and delay encompasses accepted and completed.

Wim why such a dependency on queueing? In my sim, if the STA is busy, you just don't send another one.

Carlos Your sim won't suffer as much as my graph shows, since you are not tossing pkts. On the other hand, your sim won't send pkts back-to-back. It's a subjective issue of what is more realistic - it must be considered.

Wim In my model, I use a carrier sensitivity so-many dB down from receiver sensitivity since the two are closely related. I think this view is more realistic than varying one and holding the other constant.

Laura Why would delay ever be dominant over throughput?

Michael Some upper layers have timeouts

Carlos A MAC which delivers all packets but takes long to do it is not acceptable

- Silenced CTS problem

Reasons for unanswered RTS: RTS or CTS pkt collisions 75-85%, silenced CTS 15-25%

A sends RTS to X: received by B, but not C

B goes "silent" for period requested by A

C sends RTS to B

B does not respond due to A's prior request

C retries repeatedly until A's reservation lapses

Important idea is that frequency reuse that might otherwise be possible is prevented.

Jim S How is BER reflected in the model?

Carlos Indirectly; a minimum signal-to-interference ratio must be maintained for the entire duration of a packet

Dave

Broken: silenced CTS problem

Do Better: common simulator?

Motion 5: <Kerry, Bob O seconds>

"That an ad-hoc group be formed to extend the RFMACSIM package to model the salient features of the foundation and produce 'a common MAC simulator'"

(closes issue 29.1?)

Motion 5 passed by acclamation

Dave We should set a target date for completion and results presentation by Mar '94

Ad-hoc group: Barry Dobyms, Rui Valdas, Wim Diepstraten, Marvin Sojka, KC Chen,
Pauline Yeung, Frederic Bauchot, Michael Fischer, Greg Ennis, Chris Zegelin, Kerry Lynn - chair.

IEEE P802-94/15, "A More Reliable Contention Free Access Scheme", Jim Scheussler, National Semiconductor

Bob O Are you proposing that the NAV be set to the max contention free period size at the start of each superframe?

Jim S Yes. The NAV would then be truncated by reception of the CFACK I propose.

Motion 6: <Jim S, Bob O seconds>

"To adopt the access mechanism change as defined in doc 94/15 (with the correction re: worst case NAV length calculation as discussed in mtg) by including the technique in the draft standard text."

Dave

Broken: collisions possible in contention-free period

Do Better: avoid collision in CF period by adding CFAck that all STAs hear
change NAV set from worst case=??? to worst case=??? period

Motion 6 passes <34-0-5>

IEEE P802-94/16, "Review of MAC Issues List", Greg Ennis, Symbol

(Note: Issue numbers are followed by votes on Greg's recommendations. Any discussion on an issue follows the vote. See Greg's paper for description of issues and recommendations, sec.)

Bill (Huhn?) Moves that we close each issue, in turn, by majority vote (per our instructions)

10.1 37-0-3

10.2B 36-0-5

10.3 37-1-1

10.6 38-0-0

11.3 28-2-11

Kerry Does this imply that there can be one and only one AP per BSS? Yes.

Jim S PCFs are separate from AP. Poorly worded, shouldn't close until clarified.

Dave R "No" applies in any case.

Bob O Seems to be implicit in foundation that there is only one AP

Wim You associate with AP and that makes you part of BSS. There can be another within BSA however.

Francois Uneasy with only one AP

Kerry Proposenew issue "Will MAC support the functionality of more than one AP per BSS?" (ref 2.3.1-2 in 93/190) *fails* <9-16>

11.4 32-2-3

13.3a 32-0-5 (ref 2.6 93/190)

14.2 26-3-7

14.3 4-29-3 OPEN

Dave R Distinguishes between time-bounded and connection-oriented but still wants to close

Bob O Foundation doesn't specify connection-oriented service so can't close

Greg Foundation sure doesn't support connectionless time-bounded traffic!

14.4 35-1-2

16.1 39-0-0

Barry Will be very hard!

Dave PAR strongly implies

16.5 6-15-10 OPEN

Kerry It tries to get us to define what we mean by mobility, i.e. what are the limits?

Dave Would like to see it go away

Chan This is a PHY issue re:"forklift speed"

17.3 36-0-0

17.5 34-0-3

18.1 37-0-0

18.2 35-0-1

19.1 36-1-0

19.2A 28-0-7
19.2B 29-0-5
19.11 28-0-3
20.2 28-0-3
20.4 32-0-0
24.1 31-0-1
24.6 18-11-0

Jeanine Valadez Perhaps semantics, but should be transparent to MAC. (Old argument of whether Adaption Layer belongs in MAC or PHY.)

Dave R Not specified in foundation, so don't close.

Adjourn 6:00PM

Wednesday, January 12, 1994

The meeting was called to order by chairman Dave Bagby at 8:35AM, Kerry Lynn secretary.

- Resume discussion of Greg's paper

24.7 3-24-4 OPEN

Michael Transparent to what? LLC?

Jim S Age old question of where line between MAC/PHY is drawn.

Kerry Model postulates an Adaption Layer. Supposed to be transparent at that boundary. Don't close - will be a big area of controversy.

Chan If you define a single MAC/PHY interface, discriminates against channelized PHY

25.1 21-1-11

Dave R Sees this issue as "what is the procedure for acquiring channel capacity?"

i.e. call setup procedure.

Kerry Could be construed to include RTS/CTS

25.2A 27-1-5

25.2B 27-1-5

Kerry PAR says we must provide TBS. Can't have overlapping PCFs on single channel.

26.1A 33-0-0

27.1 37-0-0

Motion is passed.

- Other issues we can close due to foundation adoption or because nugatory

Francois on Issue 1.1 (educates us on the subtleties of the English language)

Must, Shall, or Mandatory: item is an absolute requirement for compliance with this standard

Should: This item is highly desirable

May or Optional: The item is not compulsory, and it is followed or ignored according to the needs of the implementor. If optional features are implemented, they must be compliant with the standard.

Not Applicable: The item is outside the scope of this standard.

Recommends closing issue 1.1 with these definitions. <38-0-0>

Dave Let's close non-technical issues by voice, technical issues by show of hands; if we get stuck on any, I want to move on

- 1.2 unanimous close as obsolete
- 1.3 unanimous close as obsolete
- 2.1 OPEN** Chan will bring back recommendation
- 3.1 unanimous close as obsolete
- 7.1 unanimous close as obsolete
- 7.2 unanimous close as obsolete
- 8.1 split:
- 8.1A OPEN**
- 8.1B unanimous close as obsolete (due to Jan decision)
- 9.1 OPEN**
- 9.2 unanimous close as obsolete
- 9.3 unanimous close as obsolete (only one MAC!)
- 9.6 unanimous close as obsolete
- 10.4 unanimous close as obsolete
- 13.6 29-1-7 (ref: 93/190)
- 15.1 OPEN**
- 15.3 OPEN** (change to "What is the MAC TB service interface and is it different from LLC?")
- 15.4 24-2-11 close as obsolete
- 15.5 unanimous (ref: 93/190)
- 15.8 31-3-5 no, we already decided that TB is an option, conformant STAs not implementing TB shall not cause interop. problems with STAs that do implement TB.

Chan There may be a problem with TB and async interop.

Frederic opposed to optionality

- 15.9 OPEN**
- 15.11 OPEN**
- 16.4 OPEN** thinks this refers to stability issue

Chan Close now but reopen when someone can address overload issues

- 17.1 unan (ref: votes for 19.2A&B, 17.3, 17.5)
- 17.2 unan (ref: 17.1)
- 17.4 OPEN**
- 19.3 OPEN**
- 19.5 26-0-4 (ref: 93/190)
- 19.7 OPEN**

Kerry Bears directly on the stability of backoff algorithm

Michael Other standards specify a limit

- 19.8 28-1-5
- 19.10 unan (ref: 93/190)
- 21.2 unan (ref: 19.8)
- 21.3 unan
- 24.2 unan irrelevant
- 28.1 33-0-4

Desperately need work relating to MAC/PHY interface for next meeting.

Break 10:30-10:50

- Working in multi-cell environment; single-cell sims not necessarily realistic

Dave Struggling with a dilemma. Am I hearing you say foundation could be improved by making it look more like GRAP? I need guidance from the group as to whether we should spend time on this.

Kerry We are charged with studying and enhancing foundation w.r.t. performance

Phil B Our time is better spent listening to KC rather than debating whether we should listen to him. His point about lack of multi-cell sim results is well taken.

Dave I hear a lot of support, let's proceed

- KC shows overlapping cells with STA J in overlap area. STAs in cell 1 may also interfere in cell 2. Problem for ALOHA protocols. Hard to model. Do it all with probabilities. Probability params: 1) hidden terminal, 2) in overlap, 3) interference

-hidden term: wrt a given STA, portion of other stations in cell which are hidden. i.e. if any of x% of the nodes in cell tx to AP, I won't sense their tx. If none of them transmit, there is no impact

Kerry So the main difference between hidden term. and interferer is that the former are in your cell and the latter are in adjacent cell? Yes.

- Gives RAP procedure, requires orthogonal signalling. Basic idea is that base STA can hear all others, therefore rely on him to send you a poll to give you permission to tx

My Le Your approach seems to rely on a base STA, does it apply to ad-hoc?

KC Any STA can be the base

My How can you guarantee that elected STA will not be hidden from any other?

Wim seems to place new and unusual demands on PHY

Kerry Perhaps you can compare this to RTS/CTS which I feel is a distributed procedure for doing the same thing.

KC I think this is very similar, and our goal is to see if we need to improve on RTS/CTS

Break for lunch

Dave Have been grappling with whether to terminate this presentation. I think the best thing is to allow KC to proceed for 15 mins without interruption so he may make his recommendations.

KC Basic scheme is similar to 4-way. AP sends REQ (=???), STA sends random addr (=RTS), AP sends POLL (=CTS), STA sends data (=DATA). Says one-to-one with 4-way LBT. (but I disagree, sec.)

- No hidden term. or near-far probs.
- Better performance, esp. multi-cell (claims linear delay/throughput)
- Stability
- Implementation

Bob O I think the problems you show with DFW are overstated

KC CSMA performance I showed is consistent with classical non-persistent CSMA results

Dave Do you propose to replace RTS/CTS with one-way GRAP? Yes. Well, I think one of the basic decisions we made was to use DCF as basis. Small change in text can have an enormous impact on result. I will have to rule it out of order, but group can override me.

Chan No need, just let group vote decide.

KC This is a decentralized approach

Dave I don't want to discuss technical points, just see if someone wants to appeal

Appeal the decision of the chair: <Chan, Henry Ngai seconds>

Decision not sustained <16-18-9>

Motion 7: <KC, Henry seconds>

"That the MAC group adopt (G)RAP as an alternative of the multiple access method in the foundation protocol."

Dave *Objects to consideration of the question* (decided in *negative* by 2/3 vote, sec.)

Motion will be considered <15-19-5 >

KC Every detail of DFW has not been nailed down, we can still change it

Michael *against*, not the proper time to raise it. Motion would be more appropriate in joint session; otherwise we make unilateral demand on PHY. KC may have good input.

Bob O Agrees with KC that DFW is not finished standard. KC has raised concerns, but not necessarily valid.

Greg Speaks against. Not one-to-one with 4-way. No ACK. We have a 5-way if that's added.

KC I just didn't show the ACK. Original REQ is somewhat conceptual. In reality the address sent by STA is the RTS, etc.

Sarosh This is simply GRAP. Only similarity between this and 4-way is the arrows.

Dave Strongly against, adoption runs counter to basic decisions. In my opinion, this changes us from DCF to PCF. Heard it requires 4 orth. channels, counter to single channel PHY.

Ammend: <Dave, Barry seconds>

"That the MAC group not adopt (G)RAP as an alternative of the multiple access method in the foundation protocol."

KC Speaks against ammendment, not true that orthogonal channels are necessary

Bob O calls, Michael seconds <36-0-6>

Motion 7 is ammended <22-9-12>

Dave R calls, Leon seconds <30-4-9>

Motion 7 is passed as ammended <20-6-16 >

January 1994

DOC: IEEE P802.11-94/27

IEEE P802.11-94/12, "Evaluation of the DFWMAC", Chan Rypinski, LACE

- Disqualifying problems:

Must have a plan for frequency reuse. Not something you can fix later. Must account for it in the architecture.

Use of absence of info to sense quiet channel (carrier sense, prioritization, and NAV) will lead to loss of capacity under high loads "Busy lock-out" problem. Susceptible to jamming.

Transfer delays appear to be excessive in TBS

Other groups have already discovered that telecom services cannot be provided at LLC/MAC boundary. What we really have are three MACs on top of a PHY level multiplexor. Argues for separate MAC interface to telecom services.

Potential non-responsiveness to 802.11 functional requirements:

- Reservation portion is optional, there may not be a common station type
- limiting some functions of PCF to certain configs is a problem - malfunction prone
- DFW cannot be proven to comply with any minimum service requirement

Optional contention-free aspects will only be partially satisfactory. Default deployment will be DCF.

Recommends:

- Contention-only portion of DFW as entry-level subset with a factual representation of its capabilities. Should be for 2.4 GHz PHYs
- Better performance, develop repeater based power-saving, etc.
- Eliminate incompatible 802.11 functional req's

Bob O agree freq reuse is issue, but why MAC and not PHY issue?

Chan MAC requires a PHY which handles it. Would prefer to get on to next paper.

IEEE P802.11-94/13, "Morphing the DFWMAC into an Integrated Services SAM", Chan Rypinski, LACE

My model is a carpet of users, need to provide 100% coverage for arbitrarily large areas. After a few acres, don't need to worry. Sees connection-based service as the key.

Dave Must we adopt all or none of your proposals?

Chan Believe they can be adopted piecemeal, as group prefers

Greg Challenges the assumption of single high-capacity channel

Chan That's the best way to do it, so that's what I assume

Adjourn 3:00PM

Thursday, January 13, 1994

The meeting was called to order by chairman Dave Bagby at 8:45AM, Kerry Lynn secretary.

- Resume discussion of Chan's paper

Chan This is a pretty dry topic and may be better presented in a one-on-one. I'll just present my basic concerns and save the detail for another time.

slide 2:

1) Start by saying primary mode is PCF, contention mode is used when PCF unavailable. Have to design superset first, then subsets are better understood and define. Suggests parts of foundation now optional (RTS/CTS, PCF) be

made mandatory. Doesn't affect reality, just the approach. Not a material change.

2) Define as a minimal primary mode one where all stations in a cluster work through a common repeater with a privileged antenna.

3) Delete any form of channelized PHY by using time/capacity sharing rather than freq. as a solution to overlapping radio coverage. Accept that contending repeaters must time share.

4) Activate a PCF function at the AP (formerly an enhanced repeater) that substitutes a transmit enabling message for the station channel monitoring function retaining the 4-step transfer for station-originated transfers. (Similar to CODIAC in that STA sends RTS to AP and AP returns CTS? sec.) This is a positive indication that the channel has been granted. Maintains that this step depends on previous three.

slide3:

5) Enhance the PCF function:

- Delete frame, time slots and time partitions, and NAV function. All data handled w/ same protocol. Essence of MAC multiplex; separation of different services done above the MAC. Philosophically related to 802.9??

- Replace w/ seq. async. one-at-a-time complete xfers to reduce xfer delay from wait states and status changes between transfer steps. This makes medium pkt mode usable for connection as well as connectionless.

- Background polling at one sec. intervals to

- determine a priori all associations and radio settings before a data transfer is initiated

- manage sleep mode in STAs with status available in PCF data base.

- Associating and screening functions

- Segmentation for 802 LLC-1 traffic (at STA and at any other interconnect. to external networks. MAX length of pkt is a key factor in worst-case access delay. Sees RTS/CTS exchange for first segment, then auto-grant (pos signal) messages from AP for remaining segments.

- Retain and improve ARQ function for flawed segments with reduced length repeats

- Add auto-grant/CTS message function for continuing segments of long packets

slide 4:

6) Create Extended Area Coordination Function (ECF) function to create common gateway for numbers of AP/PCF operated as a group, and to:

- create and support registration and security functions common to a system of APs

- create and store addressing, internal route/association and status in a shared DB.

- provide common-point protocol conversion for external network interfaces

- replace AP search function w/ ECF function - best AP selected w/o using channel time.

Should postulate its existence when writing standard (can specify in detail later)

7) Activate integrated services features including MAC level multiplexing

- Create segmentor for connections and multiplexor to combine connection and pkt segments for common MAC and transmission medium

- Add auto-grant/CTS

- Add D-channel pkt function recognition directed to connection protocol stack

- Add prioritization and message type recognition to the PCF

8) Add capacity enhancement features to ECF.

- Add MAC level bridging between AP/PCF within one ESA

- Add diversity selection of redundant copies when associated path fails

- Implement smart sensing of internal referers to tx enable

- Implement dynamic positioning of capacity among contiguous AP/PCF

- Implement smart APs which have more detailed radiation control

Clear (lower) limit of usefulness for video transfer is 64kbps, re: codecs done at Berkeley

slide 6: Tabulation of Major Changes Required:

These criteria require a reversal of the position of the DFWMAC on the primacy of peer-to-peer autonomous mode and DCF, and the addition of a planned approach to interference-limited radio system design. Frequency, time, or

code division channelization to solve overlapping coverage and frequency reuse problems is also excluded.

These criteria optimize: STA simplicity, power drain, and stability of function as well as maximizing capacity and minimizing delay in the communication services provided. A goal is to make changes to the DFWMAC as required to conform to these criteria.

IEEE P802-93/21, "A Distributed Time-Bounded Service", Kerry Lynn, Apple Computer
(Jim S, secretary)

See the presentation foils (doc. 94/21a) since they differ from the paper. Kerry contends that our current protocol is "broken" mainly because it does not allow the overlap of PCFs using the same channel, and PCF is required for the Time Bounded service. What we need is a contention based Time-bounded service.

The technique requires each STA to determine whether it will accept new Time-bounded traffic based on channel loading history. The metric of absolute transfer delay is used to make this decision. After some limit, the channel is deemed "full" and new requests are denied.

An advantage of this scheme is that excess Time-bounded capacity can be used by other Time-bounded users as well as asynchronous users.

There are two requirements on our protocol to meet the needs of this scheme. Residual Transit Delay and Delay Variance fields must be added to the MPDU. The RTD is decremented during the time the MPDU is in the transmit queue and stuffed into the frame as it is being transmitted. In this manner, a forwarding STA can make the determination whether the data is worth anything. If the RTD decrements to zero, the frame is considered expired and may be discarded.

The Delay Variance field is used by the receiver to buffer packets that arrive early until they can be passed up to client within constraint of delay variance.

In addition the protocol must have a priority delivery mechanism for MPDUs. Kerry presents two techniques for a priority mechanism. The first uses another Interframe Space and contention window, and the second uses a "tone" transmitted by the STA desiring Time-bounded MPDU transmission during the first async slot (causes low-priority STAs to defer.)

Actions:

- Examine issues 20.3 (frame structure) and 26.1A-C (priority access) w.r.t. DTBS
- Interested in working with others who
 - a) feel a need for additional priority access method, or
 - b) feel DTBS has merit
- Will present more details and simulation results at Mar'94 meeting

Conclusion:

Time-bounded service should be optional for right reason -shouldn't be a function of configuration.

Questions:

Are decisions to accept or deny Time-bounded service based on a Call Setup QoS or instantaneously for each current connection? Answer: not decided yet. All details not in yet.

Is there a bottleneck at the forwarding STA? Answer: Not necessarily (it uses same algorithm to prioritize MSDU transmissions and discard expired MSDUs)

Complexity: Stuffing the RTD field into the frame, based on a decrementing counter... Other protocols use a hop count field, but it has no real time constraint. This seems unique. Answer: Yes this is required, but it is no different to what we already have with the time field in the Beacon frame.

Is this priority mechanism in addition to the PCF contention-free one? Yes. It works transparently with a PCF (PIFS in current foundation is retained)

Break 10:20-10:43

- Dave reviews MAC SG report. Discussion about how draft language gets into text; concerns about including language not voted on.

Papers

Administrative Topics - all present continue to vote

Progress on Agenda Subjects

- Study Foundation

- Draft text

Major technical goal 1:

MAC/PHY interface issues -

- Adopt a functionally complete MAC/PHY interface.

- Close all issues in issues log related to MAC/PHY interface.

Major technical goal 2:

Determine final set of any additional MAC functionality for first letter ballot.

- Consideration and decision on new proposals.

- Clarification of the "you could..." portions of 93/190.

IEEE P802-94/17, Mobility Requirements, Wim Diepstraten, NCR

Functions to support mobility:

- protocol functions to perform the assoc and re-assoc functions
- functions for comm across, and with the DS

Inter Access Point Protocol (IAPP) interoperability

- Different IAPPs will be needed per DS
- It is important to provide IAPP interoperability
- What organization will be responsible for this standardization

As a minimum, 802.11 should be responsible to standardize the IAPP to support a MAC level bridge based DS.

Handoff Model

- STA to determine what AP to (re-)associate with (scan for best AP)
- STA to sync to the selected AP
- Issue (re-)association request
- New AP to identify the change of a station presence (logical location) to the DS.
- Communicate with the prev AP using IAPP to establish a disassociation of the STA with that AP
- New AP responds with Associate Response
- Connectivity is now re-established and communication can be resumed

Michael suggests that re-assoc with new AP be a two stage process: AP says "I hear you" then says "You are now associated with me". We found some failure modes trying to handle it the way you show

When to start a reassociation

- Can only be initiated by STA
- STAs need to "Scan for a better AP"
 - they start scanning based on "link quality" triggers
- STAs can loose connectivity suddenly

Seamless handoff

- What are the perf. requirements for the scanning and re-assoc. process? Differ for TBS and Async
- Effect only relevant when STAs need to re-assoc during an active file xfer
- Comm disruption should be preferably transparent to higher layers
- Longer disruptions cannot be avoided in wireless

Kerry Do you take handoff of time-bounded connections into account?

Wim The current model does not account for this yet.

Scanning process

- DFW describes two scan and sync methods
 - passive (listen to beacons)
 - active (probe, probe-response)
- Duration of scanning process is PHY dependent
- Does the standard need to specify scanning performance limits

Kerry Are Probes inherently unreliable because they are broadcast?

Wim Inbound broadcasts to AP are ACK'd

Pending Traffic Handling

- Prev AP can traffic buffered for the STA when the STA issued a reassoc. req with new AP.
- Value of this traffic depends on age
- Two strategies can be followed:
 - can be recovered over DS before any new traffic is accepted (need to preserve frame ordering)

Handoff Process (see paper)

Frame Formats

- DFW specifies x-Req and x-Rsp
- orig AP addr is an example of a parameter that might be useful to support a router based DS (e.g. Mobile-IP tunneling scheme)

IAPP Functional Requirements

Conclusions:

- An IAPP is needed to support handoff, and standardization is very desirable. 802.11 should at least standardize one flavor.
- others

New Issues:

- What org responsible for IAPP standardization
- Does the standard need to specify performance limits for handoff
- What pending traffic handling strategy should be used: flushing or recovery strategy?
- What information needs to be provided by the MAC to the IAPP to support a variety of DSs.

Greg during scanning, a station is removing itself from BSS. Power management features (traffic buffering) can be used to mitigate.

Adjourn 12:20PM